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ARSENIC POISONING DUE TO MORINAGA M. F.
DRIED MILK. 2. ARSENIC CONTENT INSIDE
THE BODY OF THE INFANTS AFFECTED WITH
ARSENIC POISONING

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[ARSENIC POISONING DUE TO MORINAGA M.F. DRIED MILK]
Hiso Chudoku Nyuji No Tainai ni Okeru Kysoryo Ni Tsuite
[(2) Arsenic Content Inside the Body of the Infants Affected
with Arsenic Poisoning]

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ARSENIC POISONING DUE TO MORINAGA M.F. DRIED MILK

(2) Arsenic Content Inside the Body of the Infants Affected with Arsenic Poisoning

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Introduction

In an arsenic poisoning incident due to M.F. dried milk manufactured by the Tokushima plant of Morinaga Milk Industry, Inc., we studied the additives used in the manufacture of dried milk, sodium phosphate used as a stabilizer, arsenic content in the organs of infants who died from this poisoning, and arsenic content in humors, excretions, hair, and nails of the infants being treated. The results of this study are reported here.

Experimental Method

There are many methods of determining a minute quantity of arsenic, including new ones such as polarography and spectrophotometry as well as the official method by Gutzeit. However, because of the urgency which does not allow enough time to test the reliability of the new methods, we decided to use the Gutzeit method which had been adopted by the Japanese pharmacopoeia and the hygienic test regulations as the official method. Although this method leaves something to be desired when a very small number is to be obtained, its operation is simple and it is quite accurate. By running a blank test each time and strictly following the standards of the official method, we strived to achieve good accuracy.

Experimental Results

1. Additives

As additives, vitamin C, ferrous lactate of the Japanese pharmacopoeia, vitamin A oil, vitamin A acetate, nicotinamide, vitamin B₁, lactose, vitamin B₁₂, vitamin D₃, vitamin D₂, millet jelly, sugar, and colloid calcium were sent to the Prefectural Health Department from the Tokushima plant. In all cases, no arsenic was detected.

2. Sodium Phosphate

Sodium phosphate used as a so-called stabilizer was a white crystal mixed with light yellow crystals. 7.11% of arsenic, or 9.38% if converted into arsenious acid, was detected from this.

3. Organs of the Infants Who Died of Poisoning

The results of the experiments on liver, kidney, bone (costa) brain, and small intestine of the infants, who died of poisoning and were dissected by Okayama University Medical School, were as shown on page 3.

When the same experiment was performed on normal infants and adults as a contrast, no arsenic was detected at all.

4. Humors, Excretions, Hair, and Nails of the Infants Under Treatment

The results of the experiments performed on the infants hospitalized at Nisseki Okayama Hospital, National Okayama Hospital, and Saiseikai Okayama Hospital were as shown on pages 4-6.

The composition in the above tables means the collection of samples from one or more persons, because a sample from one person is not sufficient. The sweat and the tears were soaked into gauze.

Amount of collected sample Arsenic content	Parts	Liver	Kidney	Costa	Brain	Small intes- tine
		20~25.5 g	10.9~26.5	11.3	25~35.8	25.2~25.8
Case 1		0.60	0	0.6	0	0
Case 2		0.52	0.15		0	0
Case 3		2.42	0.23		0	0.19
Case 4		1.60	0.19		0	0.20

The numbers above represent γ number of arsenious acid in 1 g of sample.

Hair

Number	Composition (No. of people)	Arsenic content γ/g	Amount of sample g	Hospital
1	1	29.3	2.5	(7)
2	1	16.2	3.5	"
3	4	59.0	2.5	"
4	5	34.0	3.0	"
5	4	62.3	3.1	"
6	3	27.3	2.2	"
7	5	26.3	1.9	"
8	2	17.9	2.8	"
9	1	20.0	2.5	"
10	2	40.0	2.5	"
11	1	24.0	2.5	"
12	2	32.2	2.9	"
13	2	33.3	2.8	"
14	3	21.3	2.5	"
15	10	14.7	3.4	"
16	1	4.0	3.3	(8)
17	2	10.0	1.4	"
18	2	34.0	2.5	"
19	2	31.1	3.0	"
20	3	42.4	2.4	"
21	1	48.2	2.8	"
22	1	12.5	1.6	"
23	1	26.3	3.8	"
24	2	11.0	3.4	"
25	2	65.2	2.0	"
26	2	50.0	3.8	"
27	4	31.0	2.7	(9)
28	1	16.0	3.85	"
29	2	29.0	3.0	"
30	1	6.0	4.6	"

(7)- Nisseki Okayama Hospital; (8)- National Okayama Hospital; (9)- Saiseikai Okayama Hospital

Nails, urine and feces

Kind	Number	Composition (No. of people)	Arsenic content γ/g	Amount of sample g	Hospital
Nails	1	11	52.4	0.65	(8)
"	2	Unknown	71.2	0.75	(7)
Urine	1	1	0	41.5cc	(8)
"	2	1	0	15.0	"
"	3	1	0	39.5	"
"	4	1	0	19.0	"
"	5	25	0.86	730.0	"
"	6	21	2.32	323.0	(7)
"	7	Unknown	1.47	136.0	(9)
Feces	1	3	0	3.0	(7)
"	2	7	0	5.9	"
"	3	1	0	4.0	(9)
"	4	1	0	4.0	"
"	5	1	0	4.0	"
"	6	1	0	4.0	(8)
"	7	1	0	1.9	"
"	8	1	0	4.0	"
"	9	1	0	4.0	"
"	10	1	0.8	4.0	"

(7)- Nisseki Okayama Hospital; (8)- National Okayama Hospital; (9)- Saiseikai Hospital.

Spinal fluid, blood, saliva, sweat and tears

Kind	Number	Composition (No. of people)	Arsenic content γ/g	Amount of sample g	Hospital
Spinal fluid	1	3	0	45.5cc	(7)
"	2	1	0	5.4	"
"	3	6	0	31.0	(8)
"	4	3	0	15.0	"
Tears	1	Several	0		(7)
Blood	1	5	0	15.6cc	(8)
"	2	6	0	16.8cc	"
Saliva	1	1	0	5.8cc	(7)
Sweat	1	Several	0		(8)
"	2	6	0		(7)

(7)- Nisseki Okayama Hospital; (8)- National Okayama Hospital; (9)- Saiseikai Okayama Hospital.

The same tests were performed on normal healthy people, but no arsenic was detected at all.

Summary and Conclusion

Although no arsenic was detected from the dried milk additives, 9.38% of arsenious acid was determined from sodium phosphate. This was considered to be the cause of the poisoning. Concerning the infants who died or who were under treatment, no clear conclusion could be drawn, because the degree of the symptoms, the period of disease, and the starting period of the treatment were not known, and the number of samples was insufficient. However, in the organs of the infants who died, the greatest amount of arsenic was detected in liver, then followed by kidney, small intestine, and bone. The amount in them was quite small. For those under treatment, the greatest amount of arsenic was detected in hair and nails. As Tate [1] mentioned that more than 100 γ/g of arsenic were contained in the hair of the majority of the workers at an arsenious acid factory, a special relationship between arsenic

and cystine was also assumed in this case. This seems to offer extremely useful data in judging arsenic poisoning. Only a small amount of arsenic was detected from urine. Considering the fact that arsenic is excreted in the urine via the kidney, the timing of the collection of samples could have been too late. There was only one case of a slight arsenic detection from feces; none was detected from blood, spinal fluid, sweat, tears, or saliva.

REFERENCES

1. Tate, M. Lecture at the Eighth Nippon Koshu Eisei Gakukai, 1953.